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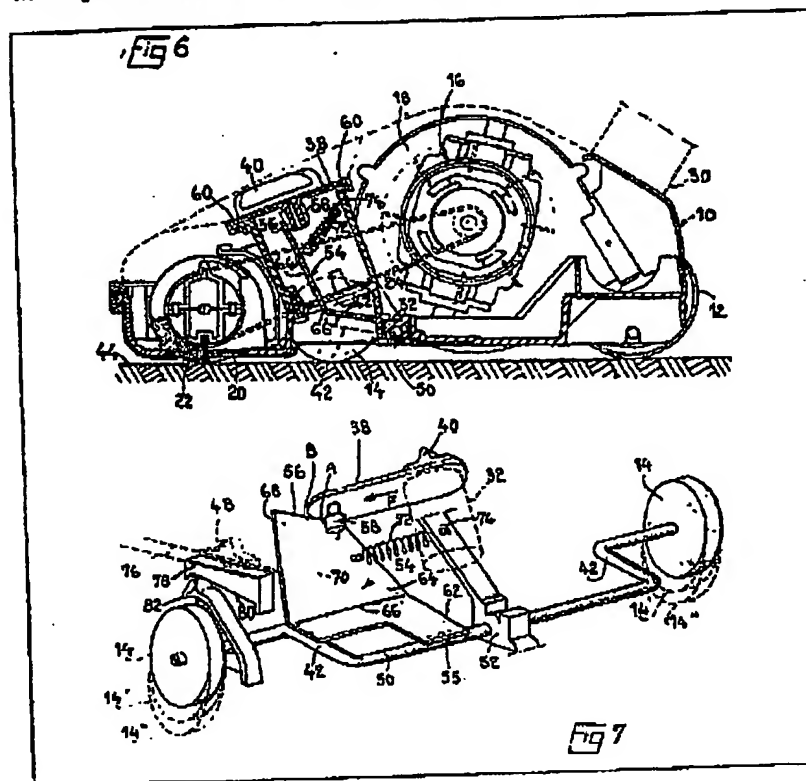
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(54) Domestic vacuum cleaner

(57) A vacuum cleaner comprises housing (10) supported on wheels (12).

(14), suction fan/motor unit (16), suction chamber (18) having main suction intake (20) and auxiliary suction intake (32), rotary brush (22), moveable flap (38) which enables suction intake (32) to be open or closed, and means for adjusting the height of the brush relative to the surface being cleaned.

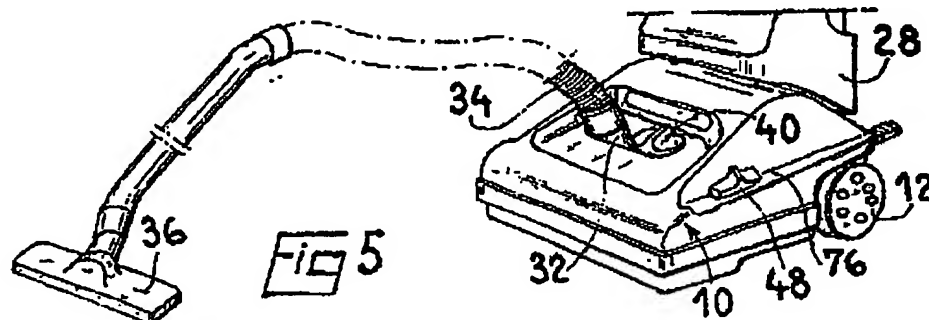
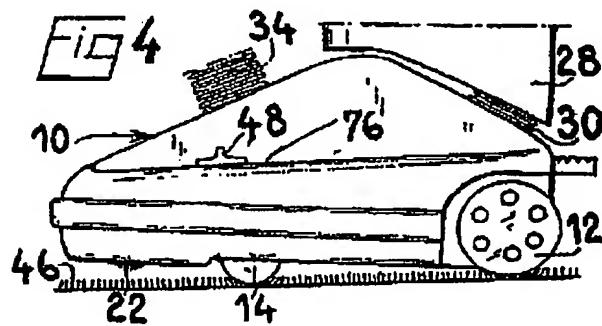
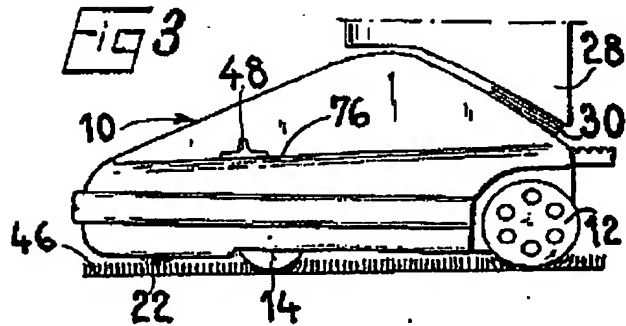
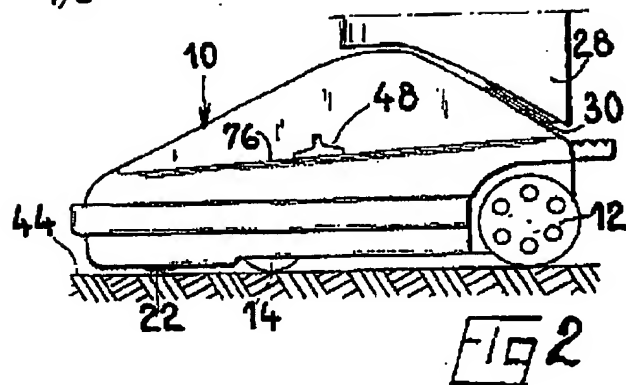
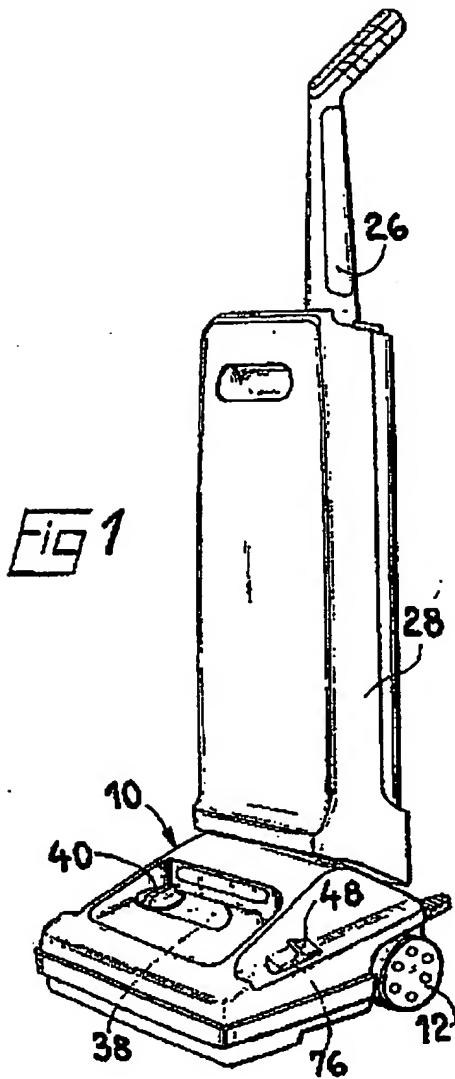
The latter comprises pivotable arms (42) on which wheels (14) are mounted, the arms being pivoted on actuation of flap (38) via a pawl (58) and lever (54) mechanism, or slide (48) via engagement of surface (80) with lug (82). The arrangement is such that when wheels (14) are in their fully raised position, brush (22) contacts the surface being cleaned, and when wheels (14) are in their fully lowered position, brush (22) does not contact the surface being cleaned. The latter occurs when the flap is moved to a position to open suction intake (32) for connection of a nozzle/hose assembly thereto.



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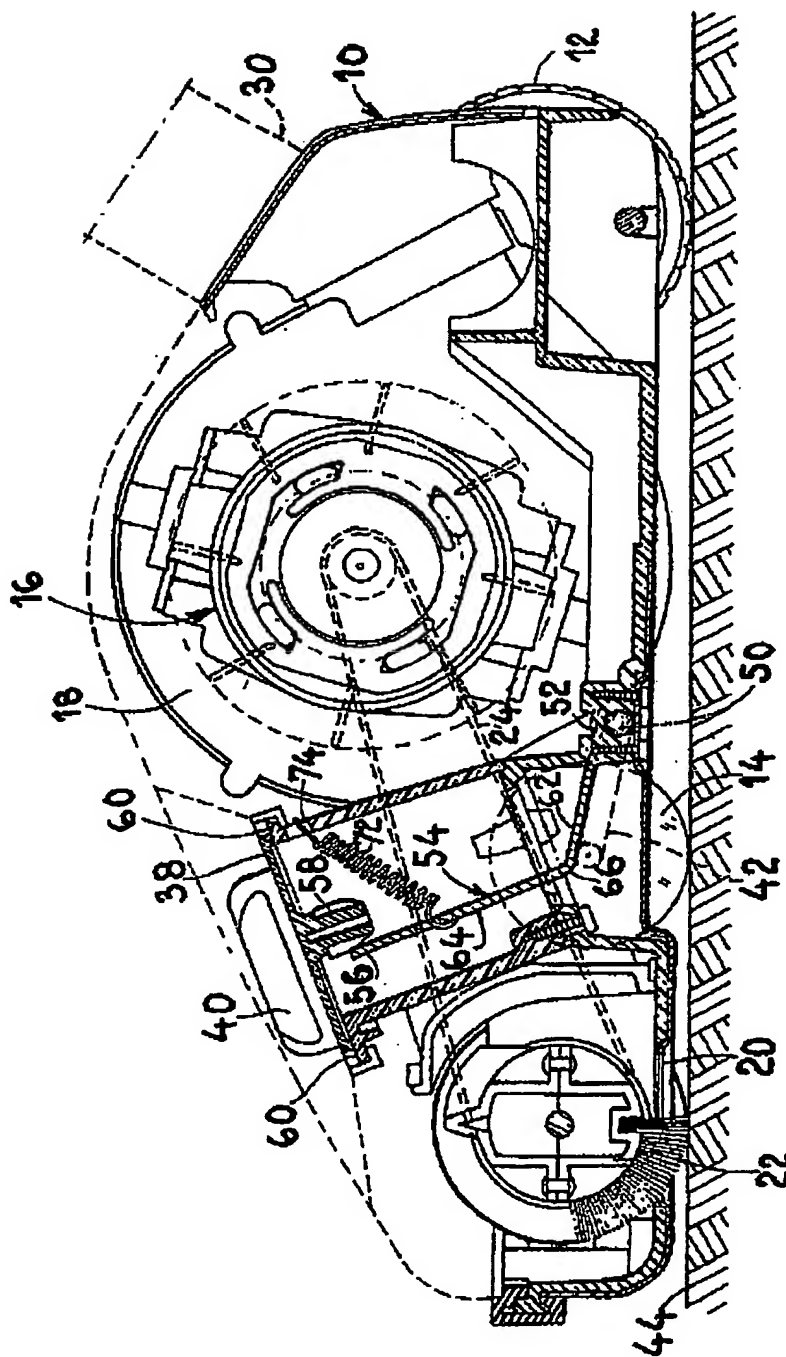


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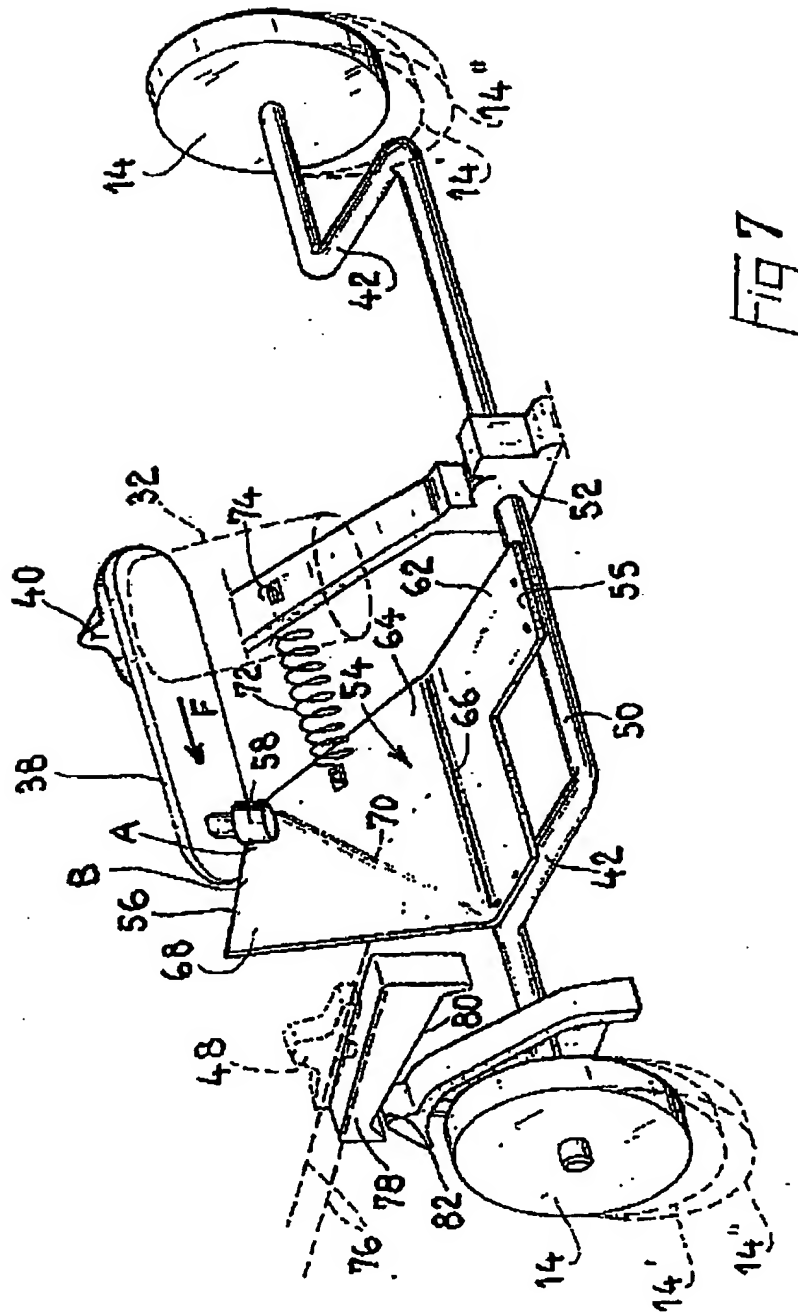
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FIG 6



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3/3



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## SPECIFICATION

## Domestic Vacuum Cleaner

5 The present invention relates to vacuum cleaners for domestic use.

A known vacuum cleaner has a housing resting on the ground via a pair of back wheels and a pair of small front wheels, and a power unit mounted inside this housing and adapted to create low pressure in a suction chamber which is also inside the housing, the suction chamber comprising a suction intake facing the ground and provided with a rotary brush driven by said power unit.

15 The invention relates, in particular, to vacuum cleaners of this known kind where the suction chamber comprises, in addition to the main suction intake facing the ground, an auxiliary suction intake located on the top of the housing. The auxiliary suction intake is equipped with a movable flap which may assume either a closed position in which it closes the auxiliary intake or an open position in which it leaves this intake exposed in order to enable the user to connect a flexible extension tube thereto, this tube being fitted, for example, with a nozzle suitable for cleaning armchairs, curtains or corners not easily reached by the main suction intake.

Vacuum cleaners of this kind may also comprise means for adjusting the height of the rotary brush arranged such that the front wheels are able to assume at least three positions, that is, an upper position suitable for cleaning a smooth floor, in which the front wheels are retracted sufficiently inside the housing to enable the brush to make contact with the floor, an intermediate position, suitable for cleaning thick carpets, in which the front wheels emerge sufficiently from the housing so that the brush is raised to a position suitable for cleaning said carpets, and a lower position, suitable for the use of the flexible tube, in which the front wheels emerge sufficiently to ensure that the brush does not make any contact with the floor covering at all, irrespective of this covering.

With this type of vacuum cleaner, it is important that the front wheels be placed in the lower position before the flexible tube is attached, so as to prevent any unnecessary beating of the carpet by the rotary brush and so as to obtain the maximum vacuum in the suction chamber as this eliminates any slowing down of the power unit set which might be caused by the friction of the brush on the ground.

According to the present invention there is provided a vacuum cleaner comprising a housing arranged to be supported on the ground by way of a first and a second pair of wheels, a power unit within the housing arranged to establish low pressure in a suction chamber within the housing, the suction chamber having a first suction intake arranged to face the ground and a second suction intake in an upper part of the housing, a rotary brush mounted in said first suction intake and rotatable by said power unit, a movable flap associated with said second suction intake, the flap being movable between a first position in which the second suction intake is open and a second position in which the second

suction intake is closed, and means for adjusting the height of the rotary brush, said adjusting means comprising a pair of arms mounted in the housing for pivoting about a substantially horizontal axis, each arm carrying one of said first pair of wheels, said arms being positionable in at least two positions, an upper end position in which the first pair of wheels is sufficiently retracted in the housing to enable the brush to contact the ground and a lower end position in which the first pair of wheels emerges sufficiently from the housing to prevent the brush from contacting the ground, wherein a mechanical transmission member is arranged between the movable flap and the arms such that movement of the flap to its first, open position positions the arms in their lower end position.

With a vacuum cleaner of the invention the brush is automatically raised when the movable flap is moved to its open position to enable the flexible tube to be attached.

An embodiment of the present invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:-  
Figure 1 shows a perspective view of a vacuum cleaner according to the invention;

Figure 2 is a partial elevation of the vacuum cleaner on a smooth floor, with the front wheels retracted sufficiently to allow the brush to touch or brush the surface of the floor;

Figure 3 is a view analogous to Figure 2, but with the brush in contact with a thick carpet, i.e. with the front wheels emerging sufficiently to bring the brush into this position;

Figure 4 is another view analogous to Figure 2 with the brush moved away from the ground, i.e. with the front wheels emerging sufficiently to achieve this, so that the flexible tube can be used;

Figure 5 is a partial perspective view, showing the flexible extension tube connected to the auxiliary suction intake and provided at its end with a cleaning nozzle;

Figure 6 shows, on a larger scale, a partial vertical section through the housing of the vacuum cleaner in the position used for cleaning a smooth floor; and

Figure 7 is a diagrammatic perspective view of the means for controlling the height of the brush showing the mechanical transmission member between the flap and the wheel-carrying arms.

The vacuum cleaner shown comprises a housing 10 resting on the ground via a pair of rear wheels 12 and a pair of front wheels or castors 14. A power unit 16 (Figure 6) comprising a fan and a motor drive for the fan is mounted within this housing and is arranged to create low pressure in a suction chamber 18 which is also within the housing 10. The suction chamber 18 comprises a suction intake 20 which faces the ground and in which a rotary brush 22 driven by the power unit 16 by means of a belt 24 is arranged.

As can be seen from Figure 1, the housing 10 has a handle 26 supporting a dust collector 28 which is connected to the suction chamber 18 by a connection 30.

In addition to the suction intake 20 facing the ground, the suction chamber 18 also comprises a

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second suction intake 32 (Figure 5) facing the top of the housing 10. The lower intake 20 will hereinafter be referred to as the "main" intake as it performs the normal function of cleaning the floor which is expected of a vacuum cleaner/sweeper of this kind. The upper intake 32 will be referred to as the "auxiliary" intake as it enables the user to attach a flexible extension tube 34 to the vacuum cleaner.

The extension tube 34 is intended for uses, such as cleaning armchairs, curtains or corners, not easily reached by the main intake 20. The extension tube 34 is fitted with a suitable nozzle 38. The auxiliary intake 32 is provided with a movable flap 38 which, by means of a handle 40, can be moved either to a closed position in which it covers the auxiliary intake 32 (Figures 1 and 7) or to an open position (Figure 6) in which it exposes the auxiliary intake 32 to enable the extension tube 34 to be connected thereto.

For controlling the height of the brush 22 relative to the floor, and thus enabling the apparatus to be adapted to suit various conditions of use, the apparatus is provided with means for adjusting the position of the front wheels 14 relative to the housing 10. As is diagrammatically shown in Figure 7, the adjusting means comprises a pair of arms 42 pivotally mounted in the housing 10 about a common horizontal axis and each having at its end one of the front wheels 14. These arms 42 can occupy at least three positions: a raised position (Figures 2 and 6, and the position shown by solid lines in Figure 7), suitable for cleaning a smooth floor 44, in which the front wheels 14 are retracted sufficiently into the housing 10 to allow the brush 22 to make contact with the floor; an intermediate lowered position, suitable for cleaning thick carpets, in which the front wheels 14 emerge sufficiently from the housing 10 (Figure 3 and reference numeral 14' in Figure 7) to raise the brush 22 into a position suitable for cleaning the carpet 46; and a very low position, suitable for the use of the flexible tube 34, in which the front wheels 14 emerge sufficiently (Figure 4 and reference numeral 14'' in Figure 7) to prevent the brush 22 from making any contact at all with the floor covering, irrespective of this covering.

The position of the arms 42 is controlled by a slider 48 mounted on the side of the housing 10, by means of which the arms 42 can be moved from the raised position (Figure 2) to the intermediate lowered position (Figure 3) or vice versa, when the flap 38 is in the closed position (Figures 1 and 7). In addition, the position of the arms 42 is controlled by the handle 40 of the flap 38 such that the arms 42 are automatically brought into their very low position (Figure 4) when the handle 40 is pushed to open the flap 38, irrespective of the position of the switch 48. This is achieved by means of a mechanical transmission member interposed between the flap 38 and the arms 42.

As is shown in Figure 7, the two arms 42 are integral with a respective end of a horizontal shaft 50 rotatably mounted in a bearing block 52 of the housing 10. The mechanical transmission member between the flap 38 and these arms 42 comprises a lever 54 one end 55 of which is fixed to the shaft 50 and extends transversely of this shaft. The free end

56 of the lever 54 constitutes a cam with which a pawl 58 is capable of engaging. The pawl 58 is carried by the flap 38. The flap 38 is mounted in slides 60 (Figure 6) for sliding movement relative to the housing 10 in a direction parallel to the shaft 50. In the embodiment shown, the lever 54 is in the form of a metal plate one extreme edge 55 of which bears on the shaft 50 and which has three planar portions, namely a first portion 62 fixed to the shaft and located in the plane of the arms 42, a second portion 64 of which is raised relative to the first portion and is connected thereto along a first fold line 66 parallel to the shaft 50, and a third portion 68, which is raised relative to the second portion 64 and which is connected to the second portion 64 along a second fold line 70 which extends at an angle relative to the shaft 50 and which starts from one end of the first fold line 66. The free edge of this third portion 68 constitutes the cam 56.

The assembly comprising the lever 54, the shaft 50, the arms 42 and the wheels 14 is urged upwardly within the housing 10 by a tension spring 72 mounted between the median portion 64 of the lever 54 and an attachment point 74 inside the housing 10.

The slider 48 for controlling the movement of the arms 42 between their raised position and their intermediate lowered position, is slidably mounted with respect to the housing on a guide 76 extending transversely of the shaft 50. This slider 48 is fixed to a runner 78 (Figure 7) which is located in the housing beneath the guide 76. The lower surface of the runner 78 carries a bearing surface 80 which is inclined relative to the guide 76. The bearing surface 80 is located above an upwardly projecting lug 82 carried at the end of one of the arms 42.

When the flap 38 is in the closed position (Figures 1 and 7) and the slider 48 is pushed backwards (Figures 2 and 7), the front wheels 14 are retracted into the housing into a position such that the brush 22 over the tangential plane common to the rear wheels 12 and the front wheels 14. This position is suitable for cleaning a smooth floor, such as parquet or tiles, for example, as has already been described.

When, starting from this position, the slider 48 is moved forwardly, the flap 38 being retained in its closed position, the lower inclined bearing surface 80 of the runner 78 acts on the lug 82 and this lowers the arms 42. The wheels 14 are thus caused to emerge and to move the brush 22 upwardly into a position suitable for cleaning carpets (Figure 3).

Thus, when the apparatus is used as a vacuum cleaner/sweeper, displacement of the slider 48 on its guide enables the height of the brush 22 to be adjusted relative to the ground to any level between the position of contact with the ground (Figure 2) and the position suitable for the cleaning of very thick carpets (Figure 3).

It should be noted that, in the position in Figure 2, the cam 56 barely makes contact with the pawl 58, whereas, in the position in Figure 3, this cam 56 is moved slightly away from the pawl 58 as a result of the downward pivoting of the lever 54 following the action of the runner 78.

If the user opens the flap 38 in the direction of arrow F in Figure 7 in order to connect the flexible

tube 34 to the auxiliary intake 32 and if, at this moment, the slider 48 is in its backward position shown in Figures 2 and 7, the pawl 58 acts on the cam 56 at the start of the sliding movement of the flap, that is, at point A shown in Figure 7. If, on the other hand, the slider 48 is in its forward position shown in Figure 3 before the flap 38 is moved the pawl 58 only acts on the cam 56 at point B, for example. In both cases, and for intermediate positions of the slider, the pawl 58, which certainly acts on the cam 56 beyond point B, brings the arms 42 into the very low position and moves the front wheels 14 into the position 14'' in Figure 7 (cf. also figure 4) when the auxiliary intake 32 is completely freed. In this position the slider 48 no longer affects the position of the wheels 14, as the lug 82 is then spaced from the runner 78.

Conversely, when the flap 38 is closed after the flexible tube 34 has been disconnected, the lug 82 is brought into contact with the runner 78 again, under the action of the return spring 72. The wheels 14 thus move back into the housing into a position in which the brush is at a level between the one in Figure 2 and the one in Figure 3, depending on the position of the slider 48 at this stage.

#### CLAIMS

1. A vacuum cleaner comprising a housing arranged to be supported on the ground by way of a first and a second pair of wheels, a power unit within the housing arranged to establish low pressure in a suction chamber within the housing, the suction chamber having a first suction intake arranged to face the ground and a second suction intake in an upper part of the housing, a rotary brush mounted in said first suction intake and rotatable by said power unit, a movable flap associated with said second suction intake, the flap being movable between a first position in which the second suction intake is open and a second position in which the second suction intake is closed, and means for adjusting the height of the rotary brush, said adjusting means comprising a pair of arms mounted in the housing for pivoting about a substantially horizontal axis, each arm carrying one of said first pair of wheels, said arms being positionable in at least two positions, an upper end position in which the first pair of wheels is sufficiently retracted in the housing to enable the brush to contact the ground and a lower end position in which the first pair of wheels emerges sufficiently from the housing to prevent the brush from contacting the ground, wherein a mechanical transmission member is arranged between the movable flap and the arms such that movement of the flap to its first, open position positions the arms in their lower end position.

2. A vacuum cleaner as claimed in claim 1, wherein the two arms are each fixed to a respective end of a horizontal shaft rotatably mounted in the housing, and wherein the mechanical transmission member comprises a lever having one end which is fixed to said shaft and extends transversely of said shaft, the other, free end of the lever forming a cam with which a pawl carried by the movable flap is

capable of engaging.

3. A vacuum cleaner as claimed in claim 2, wherein the lever is in the form of a plate, one edge of which is attached to the shaft and which is raised in the direction of the flap, whilst its free edge, opposite said fixed edge, constitutes the cam.

4. A vacuum cleaner as claimed in claim 3, wherein the plate has three planar portions, that is, a first portion fixed to the shaft and located in the plane of the pivoting arms, a second portion raised relative to the first portion and connected thereto along a first fold line extending parallel to the shaft, and a third portion raised relative to the second portion and connected thereto along a second fold line which extends at an angle with respect to said shaft and starts from one end of the first fold line, the free edge of this third portion constituting the cam.

5. A vacuum cleaner as claimed in any of claims 2 to 4, wherein the arms are urged upwardly in the housing by a tension spring attached to the lever and to an attachment point inside the housing.

6. A vacuum cleaner as claimed in any of claims 2 to 5, wherein the movable flap is mounted on the housing to be slidable parallel to the shaft.

7. A vacuum cleaner as claimed in any of claims 2 to 6, wherein said arms are also positionable at at least one intermediate position between said end positions, said adjusting means further comprising a runner which is slidable on a guide extending on the housing transversely of the shaft and which controls the movement of the arms between said upper end position and an intermediate position, the runner having a lower bearing surface which is inclined relative to said guide and is located above an upwardly directed lug carried at the end of one of the arms such that, in the closed position of the flap, the movement of the runner in one direction along the guide moves the arms from the upper end position to the intermediate position by the action of the bearing surface on the lug, whilst the subsequent opening of the flap moves the arms from the intermediate position to the lower end position by the action of the pawl of the flap on the cam of the lever.

8. A vacuum cleaner substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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